



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

UNDERGROUND STORAGE TANK (UST) SYSTEM CLOSURE
ASSESSMENT GUIDELINES

EFFECTIVE JULY 1, 2005
REVISED DECEMBER 1, 2005, SEPTEMBER 1, 2006

These Underground Storage Tank (UST) System Closure Assessment Guidelines (guidelines) provide the standard procedure for system closure in accordance with Rule 1200-1-15-.07. The UST system includes tanks, lines, and ancillary equipment. These guidelines shall be followed unless prohibited by site specific conditions or other applicable statutes, rules or regulations. If these guidelines cannot be followed, then pre-approval of any modification of the guidelines shall be obtained from the appropriate Environmental Field Office (EFO) and these changes shall be documented in the Permanent Closure Report (PCR).

This document supercedes all previously issued closure related guidelines (i.e. Closure Assessment Guidelines and Technical Guidance Document [(TGD)-011 – “Procedures to Determine the Applicable Soil and Ground Water Cleanup Levels During an UST System Closure”].

If closing chemical tanks, then contact the Division of Solid and Hazardous Waste Management at (615) 532-0780.

I. BEFORE BEGINNING ANY WORK:

- A. The UST system owner and/or operator or property owner shall complete and submit an original “Application for Permanent Closure of Underground Storage Tank (UST) Systems” (application) to the appropriate EFO at least 30 days prior to closure. For UST systems that meet current compliance standards, the closure application is valid for twelve months from the approval date. **In accordance with Rule 1200-1-15-.07, substandard UST systems shall be permanently closed immediately.**
- B. Notify the local fire department or State Fire Marshal’s office of the permanent closure. Local fire departments may have additional requirements.
- C. Obtain the appropriate sample containers from the laboratory and follow the instructions for collecting and preserving the samples. The required analyses for soil and groundwater are listed in the attached Chemicals of Concern (COC) table (Reference 1), which includes laboratory methods. The Tennessee Polycyclic Aromatic Hydrocarbon (PAH) list is attached as Reference 2.
- D. Refer to Section IV. of this document for UST system Closure-in-place.
- E. **Contact the appropriate EFO at least one working day prior to implementing any closure and/or sampling activities.**

II. GENERAL REQUIREMENTS DURING UST SYSTEM CLOSURES

A. SAMPLE COLLECTION

1. **Composite samples are not acceptable.**
2. All soil samples submitted for laboratory analysis shall be collected in accordance with Section III. or Section IV. of this document. Samples shall be chosen, based upon observation and/or field screening results, from the zone of highest suspected contamination. To avoid cross-contamination, a decontaminated hand auger, scoop, or other sampling device shall be used to collect a fresh, non-volatilized, soil sample. Clean, disposable, latex gloves shall be worn during the collection of each sample. The sample shall be immediately packed tightly into a laboratory prepared sample jar leaving no voids, labeled, and stored at 4°C until delivered to the laboratory.
3. The **original** of all laboratory analytical results shall be submitted with the PCR to the appropriate EFO. Photocopies are not acceptable. All laboratory analysis sheets shall include the following:
 - a) The Tennessee UST Facility ID Number;
 - b) Boring number or location of sample points;
 - c) Date sample was collected;
 - d) Date sample was analyzed;
 - e) Sample depth (feet);
 - f) Parameter (i.e., Benzene, MtBE, EPH, etc);
 - g) Unit of measurement (Parts Per Million, PPM);
 - h) Analytical method including dilution factor (if any);
 - i) Authorized laboratory signature; and
 - j) Chain of Custody Form

B. EXCAVATED SOIL MANAGEMENT OPTIONS

1. All excavated material shall be placed on plastic, covered with plastic during rain events, and properly bermed. If practical, obviously contaminated soil, as determined by visible and/or olfactory observations, should be segregated depending on the soil conditions. Proper screening and sampling of the excavated material in accordance with TGD-005 "Sampling and Reporting Requirements for Excavated Material" shall be completed prior to proper disposal.
2. Petroleum contaminated material remaining on the site of generation or on a site owned by the tank owner/operator or subsidiary of the tank owner/operator shall be managed in accordance with TGD-009 "Requirements to Treat Petroleum Contaminated Soil Generated from Releases from Underground Storage Tanks", and an Application to Treat Petroleum Contaminated Soil shall be completed and submitted to the appropriate EFO for approval prior to the implementation of any treatment activities. If petroleum contaminated material is to be treated on a site owned by a Third Party, then contact the Division of Solid and Hazardous Waste Management for approval.

C. CONTAMINATION MANAGEMENT OPTIONS

The appropriate EFO shall be contacted **within 72 hours**, in accordance with Rule 1200-1-15-.06, to report a confirmed release if soil and/or ground water contamination exceeds any Initial Screening Level (ISL), free product is encountered and/or surface water is visibly impacted. Failure to notify the Division may affect fund coverage of reasonable corrective action costs associated with this release for fund eligible owners and/or operators.

Once a release is confirmed and depending on the type and degree of impact, one or more of the following procedures shall be completed. Prior Division approval shall be obtained prior to implementing procedure 2 and/or procedure 3:

1. Implementation of initial abatement measures.
2. Completion of over-excavation of areas of obvious soil contamination following removal of the UST system.
3. Installation of a monitoring well and completion of a Ground Water Use Determination in accordance with the current EAG to determine if risk exists to human health and/or the environment.

D. RECORD MAINTENANCE

In accordance with Rule 1200-1-15-.07, all appropriate closure records shall be maintained by the tank owner/operator for at least 3 years.

III. UST SYSTEM REMOVAL

The removal of an UST system shall follow the procedures outlined in the APPENDIX of 1200-1-15-.07 in the UST Regulations. If any portion of the UST system is to be closed-in-place, then refer to Section IV. of this document.

A. TANKHOLD SAMPLING

1. Areas of obvious contamination shall be over-excavated prior to sampling. Contact the appropriate EFO prior to over-excavating more than 100 cubic yards of material. Soil samples shall be collected after all backfill material has been removed from the excavation. Soil samples shall be obtained from the tankhold floor at a depth of one foot below the bottom of the excavation. If bedrock is encountered during over-excavation, then a soil sample shall be collected at the soil/bedrock interface. Based on visual observation and/or field screening, soil samples shall be collected from the zone of highest suspected contamination and relative to Figure 1 on page 9 of this document. Refer to Table 1 to determine the appropriate number of samples and sample locations.
2. If water is encountered in the tankhold, then a water sample shall be collected and submitted to a laboratory for analysis of the non-drinking water Chemicals of Concern (COCs) listed in Section VI. Table 5 of this document. A maximum of 500 gallons of water may be removed and properly disposed without notifying the appropriate EFO. The treatment and disposal of contaminated water is subject to reasonable rates established by the Division. If the water recharges within 24 hours, then an additional water sample shall be collected and submitted to a laboratory for analysis of the appropriate drinking water COCs. If any contaminant concentration in the recharge water sample exceeds the drinking water ISL for any COC listed in Table 5, then a ground water monitoring well shall be installed in accordance with the current EAG.

TABLE 1 - TANKHOLD SAMPLING

TOTAL TANK STORAGE CAPACITY (GAL) PER PIT	MINIMUM NUMBER OF SAMPLES	LOCATION
1120 OR LESS	2	SEE FIGURE 1
1121 TO 15,000	4	
15,001 TO 30,000	5	
30,001 TO 45,000	6	
45,001 TO 60,000	7	

GREATER THAN 60,000 GALLONS APPROVED ON A SITE-SPECIFIC BASIS

B. PRODUCT LINE TRENCH SAMPLING

1. Areas of obvious contamination shall be over-excavated prior to sampling. Contact the appropriate EFO prior to over-excavating more than 100 cubic yards of material. If product lines are removed during closure, then a soil sample(s) shall be collected in accordance with Table 2 below for each product line trench (unless product lines are being replaced for an active system). Soil sample(s) shall be collected from a depth of one foot below the bottom of the product line trench into undisturbed soil or at the soil/bedrock interface, whichever occurs first. If bedrock is encountered during over-excavation, then a soil sample shall be collected at the soil/bedrock interface. Based on observation and/or field screening, sample(s) shall be collected from the zone of highest suspected contamination.
2. Sampling of product line trenches less than 15 feet is not required if other samples are collected at the tank-hold and/or dispensers.

TABLE 2 – PRODUCT LINE TRENCH SAMPLING

TOTAL TRENCH LENGTH (FEET)	MINIMUM NUMBER OF SAMPLES	
15 OR LESS	0	(if other samples are collected during closure)
15 OR LESS	1	(product line closure only)
16 TO 30	1	
31 TO 60	2	
61 TO 90	3	
91 TO 120	4	

GREATER THAN 120 FEET APPROVED ON A SITE-SPECIFIC BASIS

C. DISPENSER SAMPLING

Areas of obvious contamination shall be over-excavated prior to sampling. Contact the appropriate EFO prior to over-excavating more than 100 cubic yards of material. If dispensers are removed during closure, then sample(s) shall be collected below each dispenser. Sample(s) shall be collected from a depth of one foot below the bottom of the dispenser excavation or immediately above the soil/bedrock interface, whichever occurs first. If bedrock is encountered during over-excavation, then a soil sample shall be collected at the soil/bedrock interface. Based on observation and/or field screening, sample(s) shall be collected from the zone of highest suspected contamination.

IV. UST SYSTEM CLOSURE-IN-PLACE

a. PROPERTY OWNER PERMISSION

If the tank owner and/or operator is not the property owner, then a **notarized approval statement from the property owner shall be included** with the Application for Permanent Closure of Underground Storage Tank Systems. The statement shall include the facility address, tax map, and parcel number.

b. TANKHOLD SAMPLING

1. Closing an UST system in-place requires utilizing soil boring or direct-push tools capable of collecting soil samples. Properly decontaminated split-spoon samplers, hand augers, or shelby tubes shall be used to retrieve the samples from the required depths. Sampling of hollow-stem auger cuttings is unacceptable for laboratory analysis.

2. Soil samples shall be collected continuously until a depth of one foot below the tankhold floor or the soil/bedrock interface is reached. Upon opening the split spoon, the sample shall be split in half lengthwise. One side of the sample shall be immediately placed into a laboratory prepared jar in a manner that eliminates headspace. Once the potential laboratory sample has been properly stored, the remainder of the soil in the split spoon shall be classified and placed in a sealing plastic bag, leaving some air space. The bag shall be properly labeled and the sample shall be allowed to volatilize for a minimum of fifteen (15) minutes at a minimum of 68°F. All samples shall be allowed to volatilize for an equal period of time prior to screening. Once the sample has been allowed to volatilize, the headspace shall be sampled with an Organic Vapor Detector (OVD). The OVD shall either be a photoionization detector or a flame ionization detector. Soil samples submitted for laboratory analysis shall be obtained from the depth in which the OVD screening indicates the highest level of contamination.
3. Following soil sampling, if water is encountered in any boring, then a monitoring well shall be installed in the boring location where the highest OVD reading was recorded. No soil samples collected below the water table shall be sent for laboratory analysis.
4. Refer to Table 3 to determine the appropriate number of samples and sample locations:

TABLE 3 – TANKHOLD SAMPLING (CLOSURE-IN-PLACE)

TOTAL TANK STORAGE CAPACITY (GAL) PER PIT	MINIMUM NUMBER OF SAMPLES	LOCATION
1120 OR LESS	2	SEE FIGURE 2
1121 TO 15,000	4	
15,001 TO 30,000	6	
30,001 TO 45,000	8	
45,001 TO 60,000	10	

GREATER THAN 60,000 GALLONS APPROVED ON A SITE-SPECIFIC BASIS

c. PRODUCT LINE TRENCH SAMPLING

1. If product lines are not removed during closure, then a boring(s) shall be placed in accordance with Table 4 for each line trench. This boring(s) shall be placed no more than three (3) feet from any product line trench and advanced to a depth of six (6) feet below the ground surface or to the soil/bedrock interface, whichever occurs first. Sample(s) shall be collected from the zone of highest suspected contamination as determined by the highest OVD field screening result.
2. Sampling of product line trenches less than 15 feet is not required if other samples are collected at the tankhold and/or dispensers.

TABLE 4 – PRODUCT LINE TRENCH SAMPLING

TOTAL TRENCH LENGTH (FEET)	MINIMUM NUMBER OF BORINGS	
15 OR LESS	0	(if other samples are collected during closure)
15 OR LESS	1	(product line closure only)
16 TO 30	1	
31 TO 60	2	
61 TO 90	3	
91 TO 120	4	

GREATER THAN 120 FEET APPROVED ON A SITE-SPECIFIC BASIS

d. DISPENSER SAMPLING

If dispensers are not removed during closure, then a boring shall be placed no more than three (3) feet from any line trench and advanced to a depth of six (6) feet below the ground surface or to the soil/bedrock interface, whichever occurs first. Sample(s) shall be collected from the zone of highest suspected contamination as determined by the highest OVD field screening results.

e. COMPLETING THE UST SYSTEM CLOSURE-IN-PLACE

Complete this section only if the soil and/or ground water has been determined to be below the applicable ISLs specified in Section VI. Table 5 of this document.

Local ordinances that apply to the closure-in-place of underground storage tank (UST) systems shall be followed. Below are the closure-in-place procedures. A permanent record of the UST system location, date of closure, and method of closure-in-place shall be maintained for a minimum of three years.

When properties are sold or transferred, the new owners or new leaseholders should be informed of the presence of UST systems that are closed-in-place.

If petroleum contamination is not encountered or is below the applicable ISLs, then follow the procedures as outlined below:

1. Remove and properly dispose of all product from the piping and tank(s).
2. Remove and properly dispose of all sludge and drop tube(s) from the tank(s).
3. Disconnect and cap all piping not used during purging procedures. The vent line shall remain open and connected until the tank is filled with an inert solid material.
4. The tank atmosphere shall be purged and regularly tested in accordance with the provisions in 1200-1-15-.07 of the regulations.
5. Fill the tank with an inert solid material as indicated below:
 - a. Sand: Dry sand may be added to the tank as long as it flows freely. Once the tank is nearly full, a sand/water slurry shall then be used to completely fill the tank.
 - b. Sand/Soil: The tank may be filled to 80% of its capacity with sand. A free-flowing mixture of sand/soil shall then be used to completely fill the tank.
 - c. Concrete: A free-flowing concrete slurry may be used to completely fill the tank.
 - d. Concrete/Bentonite: A free-flowing concrete/bentonite slurry may be used to completely fill the tank.
 - f. Other inert solid material may be used if approved by division personnel. Foam or water are not acceptable materials.
6. Disconnect and cap the vent line.

V. GROUND WATER MONITORING WELL INSTALLATION AND GROUND WATER USE DETERMINATION:

- A. A ground water monitoring well shall be installed and sampled for all drinking water COCs if any of the following conditions exist:
1. Following over-excavation, free product is present. Also, contact the appropriate EFO within 72 hours.
 2. Soil contamination exceeding the applicable ISL for any COC listed in Section VI. Table 5 of this document, including extractable petroleum hydrocarbons (EPH), cannot be over-excavated or is in contact with bedrock.
 3. Bedrock is encountered before completing the sampling requirements in Section III. "UST SYSTEM REMOVAL" or Section IV. "UST SYSTEM CLOSURE-IN-PLACE" of this document.
 4. An analytical result from a recharge water sample collected from the tankhold exceeds the drinking water ISL for any COC listed in Section VI. Table 5 of this document.
 5. Water is encountered in any tankhold soil boring before completing the sampling requirements in Section IV. "UST SYSTEM CLOSURE-IN-PLACE" of this document.
 6. Surface water located on or near the petroleum site is visibly impacted by petroleum product including but not limited to: free product/sheen on water, free product/sheen on stream bank/sediment, and/or release of product droplets from sediment when disturbed. Contact the appropriate EFO within 72 hours.
- B. A Ground Water Use Determination shall be performed in accordance with the current EAG if any monitoring well analytical result exceeds the drinking water ISL for any COC listed in Section VI. Table 5 of this document. The results of the Ground Water Use Determination shall be submitted with the Permanent Closure Report.

The monitoring well installed as a result of conditions 1 through 5 of Section V.A. above shall be installed immediately adjacent to the area of greatest suspected or known contamination and in the apparent down-gradient direction. If no obvious area of contamination is evident, then the monitoring well shall be installed immediately adjacent to the tank excavation at the junction of the piping trench.

Prior to monitoring well placement and installation as a result of condition 6 above, contact the appropriate EFO.

The treatment and disposal of contaminated water is subject to reasonable rates established by the division. Refer to the current EAG for monitoring well installation guidance. All environmental assessment activities and evaluation of the subsurface investigation results shall be directed by a registered professional geologist under the Geologist Act (T.C.A §68-36-101 et. seq.), or a registered professional engineer under the Tennessee Architects, Engineers, Landscape Architects, and Interior Designers Law and Rules (T.C.A §62-201-101 et seq.)

A ground water monitoring well construction diagram, detailed boring log (refer to TGD-006, Standard Drilling Log), analytical results and a scaled site map shall be submitted to the appropriate EFO along with the Permanent Closure Report. The site map shall indicate the location of the ground water monitoring well(s) in relation to the entire UST system(s).

VI. COMPARISON OF ON-SITE CONCENTRATIONS TO THE INITIAL SCREENING LEVELS (ISLs)

Following over-excavation, closure-in-place, and/or monitoring well installation and sampling, soil and/or groundwater analytical results shall be compared to the applicable ISLs listed in Table 5.

TABLE 5 – INITIAL SCREENING LEVELS

CHEMICALS OF CONCERN	SOIL *Residential	SOIL *Commercial	GROUNDWATER Drinking Water	GROUNDWATER Non-Drinking Water
ORGANICS	[mg/kg]	[mg/kg]	[mg/l]	[mg/l]
**EPH	500	500	NA	NA
Benzene	0.0729	3.80	0.005	0.072
Toluene	6.78	62.2	1	4.31
Ethylbenzene	143	1310	0.7	10.3
Xylenes (Total)	9.60	88.0	10	3.57
Methyl-tert-butyl-ether (MtBE)	39.6	364	0.02	175
Acenaphthene	NA	NA	0.939	NA
Acenaphthylene	NA	NA	0.939	NA
Anthracene	NA	NA	0.0434	NA
Benzo(a)anthracene	NA	NA	0.00117	NA
Benzo(a)pyrene	NA	NA	0.0002	NA
Benzo(b)fluoranthene	NA	NA	0.00117	NA
Benzo(g,h,i)perylene	NA	NA	0.0007	NA
Benzo(k)fluoranthene	NA	NA	0.0008	NA
Chrysene	NA	NA	0.0016	NA
Dibenzo(a,h)anthracene	NA	NA	0.000117	NA
Ethylene Dibromide (EDB)	NA	NA	0.00005	NA
Ethylene Dichloride (EDC)	NA	NA	0.005	NA
Fluoranthene	NA	NA	0.206	NA
Fluorene	NA	NA	0.626	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	0.00117	NA
Naphthalene	135	403	0.02	9.81
Phenanthrene	NA	NA	0.469	NA
Pyrene	NA	NA	0.135	NA
METALS			[mg/l]	
Cadmium	NA	NA	0.005	NA
Chromium	NA	NA	0.1	NA
Lead	NA	NA	0.015	NA
Silver	NA	NA	0.1	NA
Zinc	NA	NA	5	NA

NA= Not Applicable

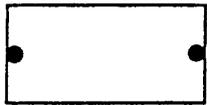
* Based on residential or commercial current use and reasonable future use of the property. If soil contamination also exists on an adjacent property, then a residential/commercial use determination shall also be performed on the adjacent property.

** EPH is used as a soil screening mechanism for the potential installation of a monitoring well only.

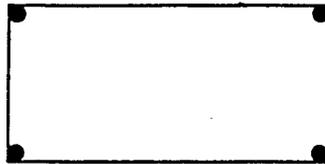
FIGURE 1

SAMPLE LOCATIONS FOR UST REMOVAL

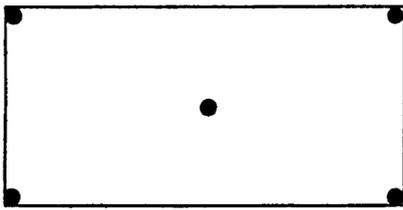
1,120 gal. or LESS



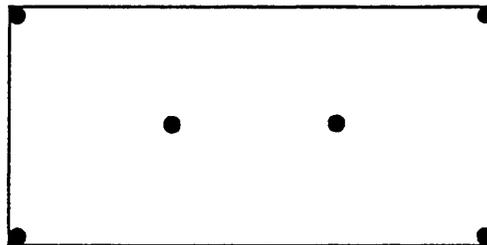
1,121 to 15,000 gal.



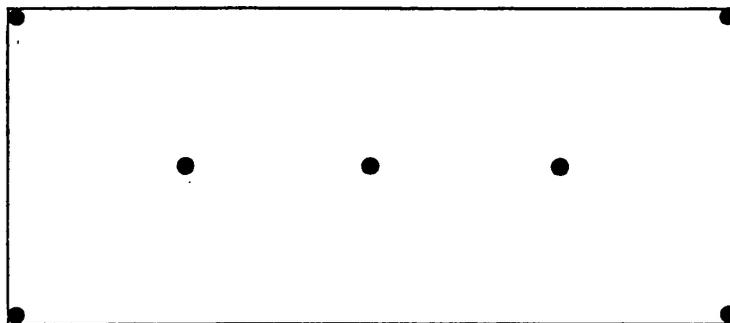
15,001 to 30,000 gal.



30,001 to 45,000 gal.



45,001 to 60,000 gal.



● - Sampling point

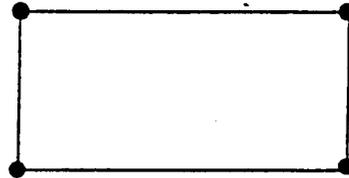
FIGURE 2

SAMPLE LOCATIONS FOR UST CLOSURE - IN - PLACE

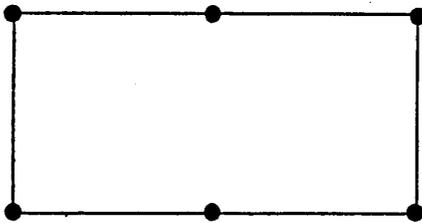
1,120 gal. or LESS



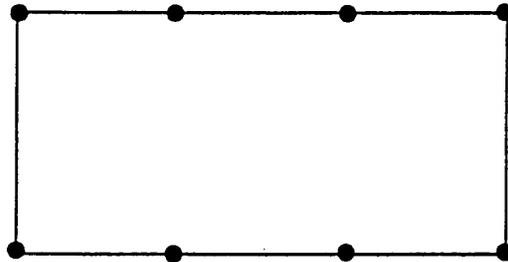
1,121 to 15,000 gal.



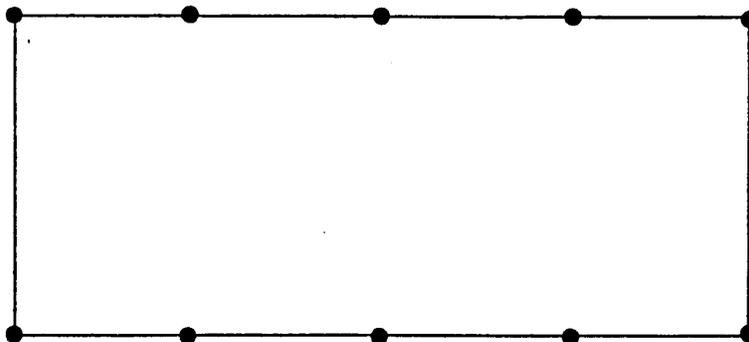
15,001 to 30,000 gal.



30,001 to 45,000 gal.



45,001 to 60,000 gal.



● - Sampling point